

The impact of shift work on burnout syndrome, depression, anxiety and stress: a case study in the metalworking industry

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Article History

Received 24 January 2017
Accepted 7 June 2017
Published 23 March 2018

Keywords

burnout syndrome
depression
stress
shift work
night work

DOI:

[10.24840/2184-0954_002.001_0001](https://doi.org/10.24840/2184-0954_002.001_0001)

ISSN:
2184-0954

Type:
Research Article

 Open Access
 Peer Reviewed
 CC BY

Abstract

Shift work has been linked to health disorders, decreases in workers' safety and productivity, and poor family and social relationships. However, the relationship between this type of work and the incidence of psychosocial health disorders is not yet well characterized. This study aims to analyse the impact of the shift work in the prevalence of the burnout syndrome, anxiety, depression and stress. A total of 175 workers from the production sector of a metalworking industry, operating in three different shifts (morning, afternoon and night), participated in the study. The burnout syndrome was assessed with the Shirom-Melamed Burnout Measure and the anxiety, depression and stress were measured through the Depression Anxiety Stress Scales (DASS). The obtained levels of burnout syndrome and stress were low, while anxiety and depression exhibited higher levels. Contrary to what was expected, the morning shift presented higher levels of psychosocial health disorders. However, no significant differences were found between the three shifts. These results can be explained by several factors such as the workers' age, years of work in the shift work and the existence of a second job.

1. INTRODUCTION

Work and workplaces have undergone significant changes due to competitive pressures, technological breakthroughs, organizational developments and social needs (Coelho, 2010). The economic situation of the countries has also an important influence in working conditions and work organization. In regard to Portugal, it is important to emphasize the economic crisis that this country has been through in the last few years, which led to the implementation of austerity measures and structural reforms by the government (Costa, 2012; Karanikolos et al., 2013). Private companies were also forced to react. Consequently, there was an increase in weekly working hours, as well as changes in work schedules, temporary work, increases in workload and time pressure for workers, among others (Costa, 2012), which can potentiate health problems, such as psychosocial health disorders (Karanikolos et al., 2013; Loureiro et al., 2014; Sigursteinsdóttir & Rafnsdóttir, 2015).

According to the Eurofound and EU-OSHA (2014), psychosocial risks "arise from poor work design, organization and management, as well as a poor social context of work, and they may result in negative

psychosocial, physical and social outcomes". Within this framework, the work schedule is an important factor of the working context that can increase the risk of psychosocial health disorders, mainly in regard to shift work, night work, long and unsociable working hours or rotating shifts ([Eurofound and EU-OSHA, 2014](#)). Results of the 6th European Working Conditions Survey published in 2016 showed that a considerable amount of workers work outside the conventional working hours, being shift work carried out by 21% of the workers, while 19% reported working in the night shift ([Eurofound, 2016](#)). Shift work is more common among young workers, which are also more exposed to job insecurity than other workers. The same report emphasize that more than half of all workers work at least one Saturday per month (52%), while a third (32%) work long days of 10 hours or more at least once a month.

Despite the benefits of shift work and night shifts, such as competitiveness and productivity, there are important and negative consequences for the workers who do their jobs under these schedules. Some studies suggest that shift work, particularly including night shifts, is related to the disruption of the circadian rhythm, since the regular sleep schedule is inverted ([Costa, 2010](#); [Bercz & Jaffe, 2012](#)). On the other hand, shift work leads to changes in people's habits, compromising their health (such as increased smoking and irregular and poor meals) ([Knutsson, 2003](#); [Parkes, 2006](#)). Furthermore, previous studies pointed out that shift and night work can be related to changes in sleep quality and quantity ([Ohayon et al., 2010](#); [Boivin & Bordeau, 2014](#); [Vallières et al., 2014](#)) as well as gastrointestinal disorders ([Caruso et al., 2004](#); [Drake et al., 2004](#)), cardiovascular disorders ([Knutsson, 2003](#); [Pimenta et al., 2012](#)), diabetes mellitus ([Gan et al., 2014](#)), metabolic syndrome ([Pietrojuti et al., 2010](#)), various types of cancer ([Kolstad, 2008](#); [Jia et al., 2013](#)) and psychological disorders such as stress, anxiety, depression and Burnout syndrome ([Costa, 2010](#); [Bara & Arber, 2009](#); [Hemamalini et al., 2014](#); [Wisetborisut et al., 2014](#), [Ma et al., 2015](#)). Besides the health issues, there are also consequences for workers' safety. In fact, studies show that the risk of suffering a work accident is higher among workers of night shifts than in workers who perform their duties during the day ([Folkard & Tucker, 2003](#); [Swanson et al., 2011](#)). Furthermore, these workers seem to have problems in the reconciliation between their work and their family and social activities ([Costa, 2010](#)), which leads to marriage problems, difficulties in accompanying their children's education and less participation in social activities ([Williams, 2008](#)).

Regarding psychological health outcomes, some studies pointed that an increased incidence of stress, anxiety, burnout syndrome and depression in night workers when compared to day workers ([Bara & Arber, 2009](#); [Hemamalini et al., 2014](#); [Wisetborisut et al., 2014](#), [Ma et al., 2015](#)). However, these psychosocial health outcomes can be also relevant in other shift works due to the presence of other risk factors. In fact, more studies about the effects of this type of work and the incidence of psychological health outcomes are still needed. In view of this, this study analyzes the impact of the shift work in the prevalence of the burnout syndrome, anxiety, depression and stress. Its main aim is to explore whether these psychological outcomes are higher in the night shifts when comparing to the day shifts.

2. MATERIALS AND METHODS

2.1 Sample

A total of 191 workers from a metalworking industry located in the North of Portugal were included in the study. The workers operate in three different 8-hour shifts: morning shift between 6 a.m. and 2 p.m.; afternoon shift between 2 p.m. and 10 p.m. and night shift between 10 p.m. and 6 a.m. All the participants work in the production sector.

2.2. Instruments

For the data collection, a questionnaire made up of two parts was developed. The first part includes questions related to the workers' demographic characteristics, such as age, gender, academic background, marital status, type of employment contract, second job, shift work, number of years working in the company, number of years working in the shift work. The second part consists of two scales aimed at measuring Burnout syndrome, anxiety, depression and stress levels.

Shirom-Melamed Burnout Measure (SMBM)

The Burnout syndrome was assessed through the Shirom-Melamed Burnout scale developed by Shirom and Melamed (2006) and adapted to Portuguese by Gomes (2012). This scale was pointed by the authors as an alternative measure of burnout, revealing more information about the burnout process than other existing scales (Shirom & Melamed, 2006). It measures the three dimensions of the Burnout syndrome: physical fatigue, cognitive weariness and emotional exhaustion through 14 items assessed by a 7 point Likert scale (1=never; 7=always). The value 5 (sometimes) was assumed as a cut-off in the Likert scale to indicate higher levels of Burnout and for each of the three dimensions. The Cronbach's alpha for this scale was 0.93, 0.92, 0.86 and 0.92 for the physical fatigue, cognitive weariness, emotional exhaustion and Burnout syndrome, respectively.

Depression Anxiety Stress Scales (DASS)

Depression, anxiety and stress were measured through the Depression Anxiety Stress Scales (DASS) developed by Lovibond and Lovibond (1995) and adapted to Portuguese by Ribeiro et al. (2004). The DASS scales has the capacity to separately measure states of depression, anxiety and stress, which is useful for researchers dealing with complex links between environmental demands and emotional and physical disturbance (Lovibond and Lovibond, 1995). The scale has a total of 21 items, seven for each subscale, and uses a Likert scale ranging from 0 to 3 (0=it did not apply to me at all; 3=it applied to me very much or most of the time). The risk level for the three subscales was calculated and classified according to the DASS manual as: normal, mild, moderate, severe and very severe. In the present study, the Cronbach's alpha scores for the depression, anxiety and stress subscales were 0.87, 0.81 and 0.80, respectively.

2.3 Procedures

The questionnaire was handed to the workers by the research team. The participants were informed about the aim of the study. They were also told that the questionnaire was voluntary and anonymous and if they had experienced any difficulties in answering any of the questions, they could request assistance from the researchers. The workers completed the questionnaires at the end of the shift and delivered them to the head researcher.

2.4 Statistical Analysis

The SPSS version 22 was used for the statistical analyses. Descriptive statistics were used for demographic data. Non-parametric procedures were adopted for the comparisons between groups after verifying that the data was not normally distributed (Kolmogorov-Smirnov test). The Kruskal Wallis test was used to compare more than two independent samples and the Mann-Whitney test to compare two independent samples. Qui-square test was use to analyse group differences when the dependent variable was measured at a nominal level. The significance level was set at 5% ($p < 0.05$).

3. RESULTS AND DISCUSSION

Of the total 191 questionnaires delivered, 175 (91.6%) were considered valid for the statistical analysis. The majority of the workers considered for this study were males (58.4%) with mean age 40.7 years old ($SD = 10.4$ years). Most of respondents had permanent employment contracts (72.2%) and only 5.8% had a second job. Table 1 shows the distribution of the participants according to their sociodemographic data. The analysis of the respondents' distribution by shift work showed significant differences in the workers' profile for gender, type of contract, mean of years working in the company and mean of years working in the shift. All the workers operating in the night shift were men, and were also the last employees hired by the company. Furthermore, considerable percentage of the workers from this shift was temporarily contracted.

Figure 1 shows the burnout syndrome's total scores. Figures 2-4 give a detailed analysis of the three dimensions of the Burnout syndrome according to Shirom and Melamed (2016): physical fatigue, cognitive weariness and emotional exhaustion. The data showed that burnout syndrome scores were generally low among participants (Figure 1). Only in the morning shift high levels of burnout were found in 2.5% of the workers, which represents a small quantity of workers. These results are similar to the ones from other study conducted in a forest industry where only 3% of the workers exhibited severe levels of burnout (Ahola et al., 2009). The Burnout syndrome is more common in professions linked to health care, education and public

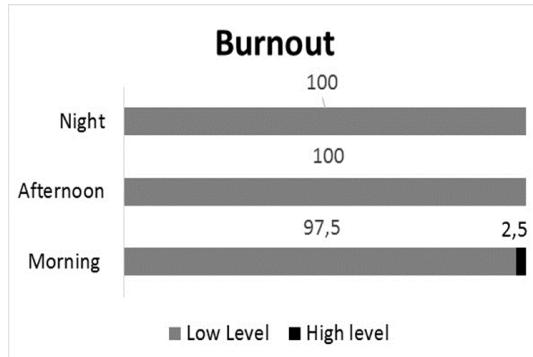
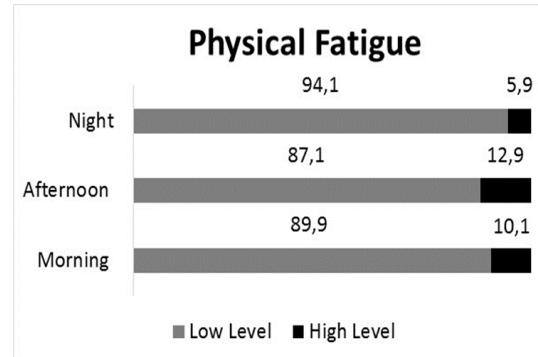
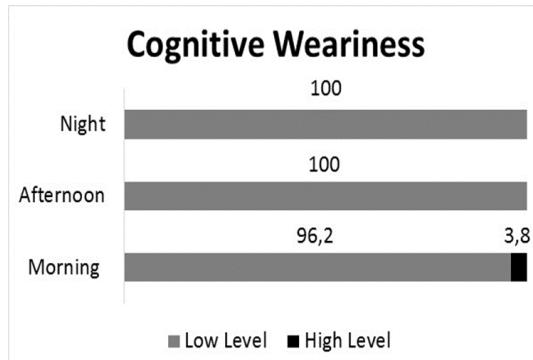
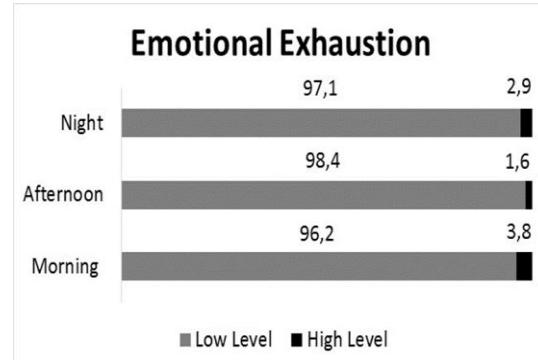
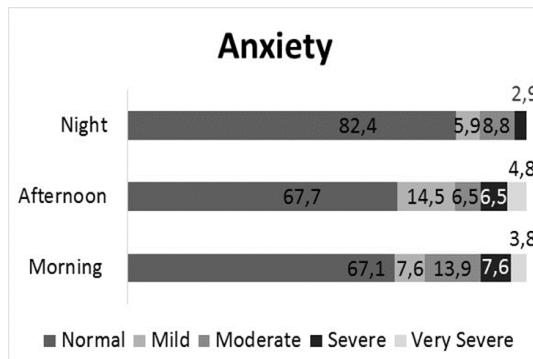
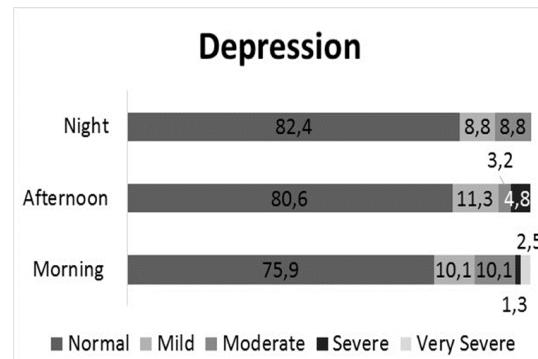
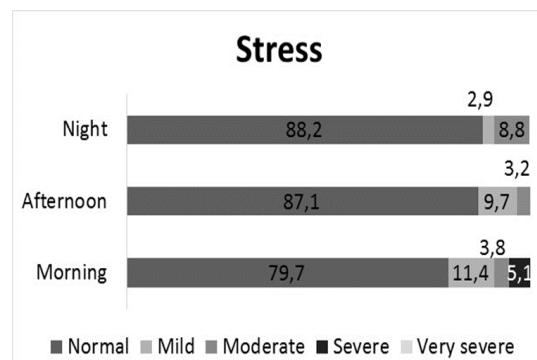
assistance, which represent a higher risk for emotional exhaustion (Coelho, 2010). This might justify the low scores obtained among the participants of our study, which was developed in an industrial setting. No significant differences in the burnout syndrome scores were found between the three shift works ($X^2 = 2.444$, $p=0.295$).

Table 1. Demographic and professional characteristics of workers, by shift work

	Morning Shift (n=79)	Afternoon Shift (n=62)	Night Shift (n=34)	Total (n=175)	Differences between shift work p-value
Gender					0.000
% Male	47.4	49.2	100.0	58.4	-
% Female	52.6	50.8	0.0	41.6	-
Mean age (sd)	41.5 (9.3)	40.7 (9.5)	38.8 (13.8)	40.7 (10.4)	0.646
Mean of years working in the company (sd)	9.5 (7.4)	8.6 (9.5)	4.7 (3.2)	8.3 (7.9)	0.001
Type of contract					0.011
% Permanent	82.1	70.5	54.5	72.7	-
% Temporary	17.9	29.5	45.5	27.3	-
Mean of years working in the shift (sd)	8.0 (7.7)	6.6 (5.7)	4.1 (3.4)	6.7 (6.5)	0.015
Second job					0.525
% Yes	7.8	6.6	0.0	5.8	-
% No	92.2	93.4	100.0	94.2	-

Among the different burnout syndrome dimensions, high scores of physical fatigue were found in the three shift works (Figure 2). Regarding cognitive weariness and emotional exhaustion, high risk levels were found in workers of the morning shift, even though in a small percentage (Figure 3 and 4). However, no significant differences were found between the three shift works for any dimension (physical fatigue: $X^2=1.170$, $p=0.557$; cognitive weariness: $X^2=3.688$, $p=0.158$; emotional exhaustion: $X^2=0.595$, $p=0.742$). The levels of physical fatigue were expected to be higher among this population, due to the higher physical effort that these workers are subjected. It is also important to notice that their function requires monotonous and repetitive tasks. A study conducted in Brazil showed that tasks with a repetitive and monotonous character were related to high levels of fatigue (Vasconcelos et al., 2011). Even so, the results for physical fatigue were higher than the results for cognitive weariness, which makes sense since the work performed is physical.

Results for anxiety, depression and stress are presented in Figures 5-7. The data shows very severe levels of anxiety in the morning and afternoon shifts, and severe levels of depression in the morning shift. Stress levels were generally low (Figure 7); however, 5.1% of the workers from the morning shift presented severe levels. These results are in line with the ones from other study conducted among workers from a car manufacturing company, where high levels of anxiety and low levels of stress were found (Edimansyah et al., 2008). Another study showed high levels of anxiety in industrial workers but also high levels of stress and low levels of depression (Rao & Ramesh, 2015). The high levels of anxiety can be related to high demands and low control among machine operators (Edimansyah et al., 2008). In fact, in the industry sector there are production goals and objectives that the workers need to accomplish during the shift, as well as requirements and deadlines imposed by the head of production. However, it is important to notice that the production goals are not always attainable. Other studies showed that these factors are associated with anxiety and depression (Sanne et al., 2005; Plaisier et al., 2007). Despite the higher levels of anxiety and depression found in the morning shift, no significant differences were found for any subscale between the three shift works (anxiety: $X^2=3.210$, $p=0.201$; depression: $X^2=0.920$, $p=0.631$; and stress: $X^2=2.073$, $p=0.355$).

**Figure 1.** Burnout levels by shift work**Figure 2.** Physical fatigue levels by shift work**Figure 3.** Cognitive weariness levels by shift work**Figure 4.** Emotional Exhaustion levels by shift work**Figure 5.** Anxiety levels by shift work**Figure 6.** Depression levels by shift work**Figure 7.** Stress levels by shift work

Despite the unexpected absence of statically significant differences, where higher levels of the burnout syndrome, anxiety, depression and stress were expected in the night shift, the results show that, in general, these disorders were more prominent in the morning shift and lower in the night shift. In fact, evidence on the higher incidence of psychosocial health disorders in the night shift is still not clear. Although some studies show a prevalence of these disorders in night workers ([Bara & Arber, 2009](#); [Hemamalini et al., 2014](#); [Wisethborisut et al., 2014](#), [Ma et al., 2015](#)), other studies presented no differences between day and night workers ([Øyane et al., 2013](#), [Thun et al., 2014](#)).

The higher levels of psychosocial health disorders found in the morning shift in this study can be explained by several factors such as the workers' age, as well as high working demands and low task control, when compared to other shift works within the same company. In fact, when workers were reunited, significant differences were found in relation to the age for burnout (age: $X^2=11.692$, $p=0.020$). Higher levels of psychosocial health disorders were identified in the oldest workers, which confirms the results of previous studies which found that depression and burnout symptoms were more frequent in older individuals ([Lindblom et al., 2006](#); [Ahola et al., 2008](#); [Thun et al. 2014](#)). On the other hand, there seem to be higher work demands in shift 1 in the company under analysis. Workers from this shift work need to correct the production errors of the night shift, which are more than in the others, and deal at the same time with their production goals. Several studies have identified a decrease in production and an increase in errors in the night shifts ([Harrington, 2001](#); [Folkard & Tucker, 2003](#); [Hanna et al., 2008](#)). These factors can contribute to more demanding production goals in the next shift work (morning shift) in order to fill in the errors committed in the night shift, which can increase the levels of anxiety and stress in the workers of the morning shift. In addition, the presence of production managers who control the activity of workers, as opposed to what happens in the night shift, can contribute to their feeling greater pressure and thus greater levels of stress. Another factor that can contribute to these results is the existence of a second job. Levels of depression ($U=481.0$, $p=0.001$) and stress ($U=612.0$, $p=0.005$) were significantly higher among workers who had a second job. These individuals work more than 40 hours per week, which, according to some studies, can increase the symptoms of stress and depression. Curiously, the morning shift has a higher percentage of workers in these conditions, despite the absence of significant differences between shift works ([Table 1](#)).

There are also some factors that can explain the lower levels of psychosocial health disorders in the night shift, such as the number of years at the shift work. Bara & Arber (2009) found out that those who work for more than four years in the night shift are at a greater risk for the development of anxiety and depression. In this study, 53.1% of the workers from the night shift work in this shift for less than four years, which means they aren't yet in the "critical period" (more than four years) from which the levels of anxiety and depression are likely to increase. Besides, the workers of the night shift are all men and younger than the ones from the other shift works. As we referred, the age is a factor that can explain lower levels of psychosocial health disorders. Also gender can explain the low levels on the night shift once some studies shown higher levels of burnout and depression in females ([Lindblom et al., 2006](#); [Ahola et al., 2008](#)).

4. CONCLUSIONS

This study showed that there were no significant differences in the prevalence of psychosocial health disorders between the three shifts analyzed. Even though the levels of the psychosocial disorders analyzed were low, it seems to be important to implement risk reduction measures in all shift works, especially in shift 1. Factors related to the workers' age, years of work in the shift and the existence of a second job seem to increase the levels of psychosocial health disorders in the studied population.

The fact that the sample is not uniform in the different shift works (only male workers in shift three) was a limitation in this study. For further studies we suggest a bigger and more diversified sample, as well as other professional activities.

REFERENCES

- Ahola, K., Honkonen, T., Virtanen, M., Aromaa, A., & Lönnqvist, J. (2008). Burnout in relation to age in the adult working population. *Journal of Occupational Health*, 50(4), 362-365. DOI: [10.1539/joh.M8002](https://doi.org/10.1539/joh.M8002)
- Ahola, K., Toppinen-Tanner, S., Huuhtanen, P., Koskinen, A., & Väänänen, A. (2009). Occupational burnout and chronic work disability: An eight-year cohort study on pensioning among Finnish forest industry workers. *Journal of affective disorders*, 115(1), 150-159. DOI: [10.1016/j.jad.2008.09.021](https://doi.org/10.1016/j.jad.2008.09.021)
- Bara, A. C., & Arber, S. (2009). Working shifts and mental health—findings from the British Household Panel Survey (1995–2005). *Scandinavian Journal of Work, Environment & Health*, 361-367. DOI: [10.5271/sjweh.1344](https://doi.org/10.5271/sjweh.1344)
- Bercz, P. A., & Jaffe, F. (2012). Adverse health effects of shift work and shift work sleep disorder. *Dialogue and Diagnosis*, 3, 13-20.
- Boivin, D. B., & Boudreau, P. (2014). Impacts of shift work on sleep and circadian rhythms. *Pathologie Biologie*, 62(5), 292-301. DOI: [10.1016/j.patbio.2014.08.001](https://doi.org/10.1016/j.patbio.2014.08.001).
- Caruso, C. C., Lusk, S. L., & Gillespie, B. W. (2004). Relationship of work schedules to gastrointestinal diagnoses, symptoms, and medication use in auto factory workers. *American Journal of Industrial Medicine*, 46(6), 586-598. DOI: [10.1002/ajim.20099](https://doi.org/10.1002/ajim.20099)
- Coelho, J. A. (2010). Prevenção de Riscos Psicossociais no trabalho em Hospitais. 1ª Edição, Edições Universidade Fernando Pessoa. Porto.
- Costa, G. (2010). Shift work and health: current problems and preventive actions. *Safety and Health at Work*, 1(2), 112-123. DOI: [0.5491/SWASH.2010.1.2.112](https://doi.org/10.5491/SWASH.2010.1.2.112)
- Costa, H.A. (2012). From Europe as a model to Europe as austerity: impact of the crisis on Portuguese trade unions. *Transfer – European Review of Labour and Research*, 18(4), 397- 410. DOI: [10.1177/1024258912458866](https://doi.org/10.1177/1024258912458866)
- Drake, C. L., Roehrs, T., Richardson, G., Walsh, J. K., & Roth, T. (2004). Shift work sleep disorder: prevalence and consequences beyond that of symptomatic day workers. *Sleep*, 27(8), 1453-1462. DOI: [10.1093/sleep/27.8.1453](https://doi.org/10.1093/sleep/27.8.1453)
- Edimansyah, B. A., Rusli, B. N., Naing, L., Mohamed Rusli, B. A., Winn, T., & Tengku Mohamed Ariff, B. R. H. (2008). Self-perceived depression, anxiety, stress and their relationships with psychosocial job factors in male automotive assembly workers. *Industrial Health*, 46(1), 90-100. DOI: [10.2486/indhealth.46.90](https://doi.org/10.2486/indhealth.46.90)
- Eurofound (2016). Sixth European Working Conditions Survey – Overview report. Publications Office of the European Union. Luxembourg.
- Eurofound & EU-OSHA (2014). Psychosocial Risks in Europe: Prevalence and Strategies for Prevention. Luxembourg. Publications Office of the European Union.
- Folkard, S., e Tucker, P. (2003). Shift work, safety and productivity. *Occupational Medicine*, 53(2), 95-101. DOI: [10.1093/occmed/kqg047](https://doi.org/10.1093/occmed/kqg047)
- Gan, Y., Yang, C., Tong, X., Sun, H., Cong, Y., Yin, X., Li, L., Cao, S., Dong, X., Gong, Y., Shi, O., Deng, J., Bi, H. & Lu, Z. (2014). Shift work and diabetes mellitus: a metaanalysis of observational studies. *Occupational and Environmental Medicine*, 1-7. DOI: [10.1136/oemed-2014-102150](https://doi.org/10.1136/oemed-2014-102150)
- Gomes, A. R. (2012). Medida de “Burnout” de Shirom- Melamed (MBSM). Relatório técnico não publicado. Braga: Escola de Psicologia, Universidade do Minho.
- Hanna, A. S., Chang, C. K., Sullivan, K. T., & Lackney, J. A. (2008). Impact of shift work on labor productivity for labor intensive contractor. *Journal of Construction Engineering and Management*, 134(3), 197-204. DOI: [10.1061/\(ASCE\)0733-9364\(2008\)134:3\(197\)](https://doi.org/10.1061/(ASCE)0733-9364(2008)134:3(197))
- Harrington, J. M. (2001). Health effects of shift work and extended hours of work. *Occupational and Environmental Medicine*, 58(1), 68-72. DOI: [10.1136/oem.58.1.68](https://doi.org/10.1136/oem.58.1.68)
- Hemamalini R. V., Krishnamurthy N., Prabhavathi K. e Saravanan A. (2014). Influence of shift work on psychological health and memory performance. *Asian Journal Pharmaceutical and Clinical Research*, 7(5), 75-77. Available in: <https://innovareacademics.in/journals/index.php/ajPCR/article/view/2479/1514>
- Jia, Y., Lu, Y., Wu, K., Lin, Q., Shen, W., Zhu, M., Huang, S. & Chen, J. (2013). Does night work increase the risk of breast cancer? A systematic review and meta-analysis of epidemiological studies. *Cancer Epidemiology*, 37(3), 197-206. DOI: [10.1016/j.canep.2013.01.005](https://doi.org/10.1016/j.canep.2013.01.005)
- Karanikolos, M., Mladovsky, P., Cylus, J., Thomson, S., Basu, S., Stuckler, D., Mackenbach, J.P. & McKee, M. (2013). Financial crisis, austerity, and health in Europe. *Lancet*, 381, 1323–31. DOI: [10.1016/S0140-6736\(13\)60102-6](https://doi.org/10.1016/S0140-6736(13)60102-6)
- Knutsson, A. (2003). Health disorders of shift workers. *Occupational Medicine*, 53(2), 103-108. DOI: [10.1093/occmed/kqg048](https://doi.org/10.1093/occmed/kqg048)
- Kolstad, H. A. (2008). Nightshift work and risk of breast cancer and other cancers—a critical review of the epidemiologic evidence. *Scandinavian Journal of Work, Environment & Health*, 34(1) 5-22. DOI: [10.5271/sjweh.1194](https://doi.org/10.5271/sjweh.1194)

- Lindblom, K. M., Linton, S. J., Fedeli, C., & Bryngelsson, L. (2006). Burnout in the working population: relations to psychosocial work factors. *International Journal of Behavioral Medicine*, 13(1), 51-59. DOI: [10.1207/s15327558ijbm1301_7](https://doi.org/10.1207/s15327558ijbm1301_7)
- Loureiro, I.F., Vale, C., Rodrigues, M. & Azevedo, R. (2014). Can the external environment affect the occupational safety conditions and unsafety behaviours? In Arezes, P., et al. (eds.) (2014). Occupational Safety and Hygiene. Pp. 423-427. CRC Press, Taylor & Francis: London, ISBN: 978-00144-2.
- Lovibond, P., & Lovibond, S. (1995). The structure of negative emotional states: Comparison of the depression anxiety stress scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, 33(3), 335-343. DOI: [10.1016/0005-7967\(94\)00075-U](https://doi.org/10.1016/0005-7967(94)00075-U)
- Ma, C. C., Andrew, M. E., Fekedulegn, D., Gu, J. K., Hartley, T. A., Charles, L. E., Violanti, J.M. & Burchfiel, C. M. (2015). Shift Work and Occupational Stress in Police Officers. *Safety and Health at Work*, 6(1), 25-29. DOI: [10.1016/j.shaw.2014.10.001](https://doi.org/10.1016/j.shaw.2014.10.001)
- Ohayon, M. M., Smolensky, M. H., & Roth, T. (2010). Consequences of shiftworking on sleep duration, sleepiness, and sleep attacks. *Chronobiology International*, 27(3), 575-589. DOI: [10.3109/07420521003749956](https://doi.org/10.3109/07420521003749956)
- Øyane, N. M., Pallesen, S., Moen, B. E., Åkerstedt, T., & Bjorvatn, B. (2013). Associations between night work and anxiety, depression, insomnia, sleepiness and fatigue in a sample of Norwegian nurses. *PLoS one*, 8(8), e70228. DOI: [10.1371/journal.pone.0070228](https://doi.org/10.1371/journal.pone.0070228)
- Parkes, K. R. (2006). Shift work and health. UK: University of Oxford. 496-500.
- Pietrojusti, A., Neri, A., Somma, G., Coppeta, L., Iavicoli, I., Bergamaschi, A., & Magrini, A. (2010). Incidence of metabolic syndrome among night-shift healthcare workers. *Occupational and Environmental Medicine*, 67(1), 54-57. DOI: [10.1136/oem.2009.046797](https://doi.org/10.1136/oem.2009.046797)
- Pimenta, A. M., Kac, G., Campos, R. R., Ferreira, L. M. D. B. A., & de Fátima Silqueira, S. M. (2012). Trabalho noturno e risco cardiovascular em funcionários de universidade pública. *Revista da Associação Médica Brasileira*, 58(2), 168-177. DOI: [10.1590/S0104-42302012000200012](https://doi.org/10.1590/S0104-42302012000200012)
- Plaisier, I., de Bruijn, J. G., de Graaf, R., ten Have, M., Beekman, A. T., & Penninx, B. W. (2007). The contribution of working conditions and social support to the onset of depressive and anxiety disorders among male and female employees. *Social Science & Medicine*, 64(2), 401-410. DOI: [10.1016/j.socscimed.2006.09.008](https://doi.org/10.1016/j.socscimed.2006.09.008)
- Rao, S., & Ramesh, N. (2015). Depression, anxiety and stress levels in industrial workers: A pilot study in Bangalore, India. *Industrial Psychiatry Journal*, 24(1), 23. DOI: [10.4103/0972-6748.160927](https://doi.org/10.4103/0972-6748.160927)
- Ribeiro, J. L. P., Honrado, A. A. J. D., & Leal, I. P. (2004). Contribuição para o estudo da adaptação portuguesa das escalas de ansiedade, depressão e stress (EADS) de 21 ítems de Lovibond e Lovibond. *Psicologia, Saúde & Doenças*, 2004, 5(2), 229-239. Available in: http://www.scielo.mec.pt/scielo.php?script=sci_arttext&pid=S1645-00862004000200007&lng=pt.
- Sanne, B., Mykletun, A., Dahl, A. A., Moen, B. E., & Tell, G. S. (2005). Testing the job demand-control-support model with anxiety and depression as outcomes: The Hordaland Health Study. *Occupational Medicine*, 55(6), 463-473. DOI: [10.1093/occmed/kqi071](https://doi.org/10.1093/occmed/kqi071)
- Shirom, A., & Melamed, S. (2006). A comparison of the construct validity of two burnout measures in two groups of professionals. *International Journal of Stress Management* 13(2), 176-200. DOI: [10.1037/1072-5245.13.2.176](https://doi.org/10.1037/1072-5245.13.2.176)
- Sigursteinsdóttir, H. & Rafnsdóttir, G.L. (2015). Sickness and sickness absence of remaining employees in a time of economic crisis: A study among employees of municipalities in Iceland. *Social Science & Medicine*, 132, 95-102. DOI: [10.1016/j.socscimed.2015.03.023](https://doi.org/10.1016/j.socscimed.2015.03.023)
- Swanson, L. M., Arnedt, J., Rosekind, M. R., Belenky, G., Balkin, T. J., & Drake, C. (2011). Sleep disorders and work performance: findings from the 2008 National Sleep Foundation Sleep in America poll. *Journal of Sleep Research*, 20(3), 487-494. DOI: [10.1111/j.1365-2869.2010.00890.x](https://doi.org/10.1111/j.1365-2869.2010.00890.x)
- Thun, E., Bjorvatn, B., Torsheim, T., Moen, B. E., Magerøy, N., & Pallesen, S. (2014). Night work and symptoms of anxiety and depression among nurses: A longitudinal study. *Work & Stress*, 28(4), 376-386. DOI: [10.1080/02678373.2014.969362](https://doi.org/10.1080/02678373.2014.969362)
- Vallières, A., Azaiez, A., Moreau, V., LeBlanc, M., & Morin, C. M. (2014). Insomnia in shift work. *Sleep Medicine*, 15(12), 1440-1448. DOI: [10.1016/j.sleep.2014.06.021](https://doi.org/10.1016/j.sleep.2014.06.021)
- Vasconcelos, S. P., Fischer, F. M., Reis, A. O. A., & Moreno, C. D. (2011). Fatores associados à capacidade para o trabalho e percepção de fadiga em trabalhadores de enfermagem da Amazônia Ocidental. *Revista Brasileira de Epidemiologia*, 14(4), 688-97. DOI: [10.1590/S1415-790X2011000400015](https://doi.org/10.1590/S1415-790X2011000400015)
- Williams, C. (2008). Work-life balance of shift workers. *Statistics Canada*.
- Wisetborisut, A., Angkurawaranon, C., Jiraporncharoen, W., Uaphanthalasath, R., & Wiwatananadate, P. (2014). Shift work and burnout among health care workers. *Occupational Medicine*, 64(4), 279-286. DOI: [10.1093/occmed/kqu009](https://doi.org/10.1093/occmed/kqu009)